

## EXPANDING NORTHERN RANGES OF AQUATIC INVERTEBRATE SPECIES: A POSSIBLE EFFECT OF CLIMATE CHANGE?

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### ABSTRACT

Recent recording of aquatic invertebrate species in north-east England has generated records of a number of species either new to the region or spreading northwards. Two species were found in a brackish water site but 11 others, a mixture of dragonflies, water bugs and beetles, were all recorded from permanent, open ponds with vegetated edges. Aquatic habitat availability has increased in north-east England, mainly as a result of land reclamation of mining operations, but the observed changes of northern ranges of species are likely to be related to temperature rise, in line with other species such as butterflies.

### INTRODUCTION

There is a history of intensive recording of aquatic invertebrates in north-east England, especially of water beetles with work carried out in the late 1960s and early 1980s, culminating in the production of a species atlas (Eyre *et al.*, 1985) and habitat definition (Eyre *et al.*, 1986). Water bugs have also received considerable attention (Eyre & Foster, 1989). The records generated in the late 20th century enable temporal comparisons to be made with recent surveys, together with those in a number of recently published atlases.

Survey work in 2002, 2003 and 2004 has generated a number of species distribution records indicating expanding northern British ranges of some species. These records are given below and the observed trends discussed.

### NOTEWORTHY RECORDS

#### GASTROPODA

##### Assimineidae

##### *Assiminea grayana* Fleming

A snail species found at the top of saltmarshes, the records in the atlas of Kerney (1999) show records north to the River Humber estuary. It was found by the coast at Druridge Bay in Northumberland (NZ2798, VC 67) in August 2004 by the outflow of a lake connected to the sea.

#### ODONATA

##### Aeshnidae

##### *Aeshna grandis* (L.)

Larvae of this species were found in both a small vegetated pond and in an open large lake at Big Waters (NZ2273, 2373, VC 67), just north of Newcastle upon Tyne in May 2004 and in a vegetated pond at Minsteracres (NZ0256, VC 67) in July 2004. These sites are just north of the records given in the dragonfly atlas (Merritt *et al.*, 1996) and may be the first proof of this species breeding in north-east England.

*Anax imperator* Leach

The most northerly records for this species in Merritt *et al.* (1996) are from the Humber area and south Lancashire coast. Larvae have been found in ponds with sparse edge vegetation at Coatham Sands by the mouth of the River Tees (NZ5725, VC 62), at Portrack Marshes near Stockton (NZ4619, VC 66) in June 2003 and at Favordale, Darlington (NZ2816, VC 66) in September 2003. However, the most northerly record was from Mount Pleasant near Boldon (NZ3461, VC 66), also in June 2003.

*Brachytron pratense* (Müller)

Although there are records from south-west and central Scotland for this species (Merritt *et al.*, 1996), these are on the west coast of Britain. On the eastern side, the most northerly records are from south Yorkshire. The larvae were found at Cowpen Bewley near Billingham (NZ4825, VC 66) in May 2003 and at Warden Law, west of Sunderland (NZ3750, VC 66) in September 2003.

## HEMIPTERA

## Corixidae

*Hesperocorixa moesta* (Fieber)

Huxley (2003) did not map old records for this species from Cumbria, with the most northerly recent record from south Lancashire. It was found in a fishing pond with sparse vegetation at Tursdale (NZ3036, VC 66) in September 2003.

*Micronecta scholtzi* (Fieber)

This species was found in an urban lake at Silksworth, Sunderland (NZ3754, VC 66) in July 2003 and in a small reservoir near Edmundbyers (NZ0049, VC 66) in July 2004, both man-made water bodies with mainly bare substrata and little vegetation. Huxley (2003) shows records north to the River Humber.

*Sigara stagnalis* (Leach)

This brackish water species was found in a pool at Druridge Bay (NZ2798, VC 67), sometimes connected to the sea at very high tides. This record is north of those for the Solway area in the west and for the Teesmouth area in eastern England (Huxley, 2003).

## Naucoridae

*Ilyocoris cimicoides* (Linnaeus)

Huxley (2003) indicates that this species occurs as far north as north-east Yorkshire but a nymph was found at Big Waters in south Northumberland (NZ2373, VC 67) in May 2004.

## Pleidae

*Plea minutissima* Leach

This is now a common species in north-east England. It has been found in 2002–2004 at sites in grid squares NZ03, 14, 21, 22, 25, 27, 29, 31, 33, 34, 35, 37, 42, 43, 44 and 52, with the most northerly record from Druridge Bay (NZ2798) in May 2004. However, this expansion is recent as the species was not found during survey work in the 1980s (Eyre & Foster, 1989).

## COLEOPTERA

## Hygrobiidae

*Hygrobia herrmanni* (Fabricius)

An example of the squeak beetle was recorded from Brinkburn Pond, Darlington (NZ2816, VC 66) in September 2003. There is a 19th century record from Edinburgh, possibly associated with travelling fairs, but the previous northernmost recent British record was in north Yorkshire in 2002.

## Dytiscidae

*Laccophilus hyalinus* (DeGeer)

This species was first found in north-east England in August 2002 in County Durham (VC 66) at Wingate (NZ4037) and Waldrige Fell (NZ2449), the latter the most northerly British record. It has also been found in this county at Billingham (NZ4623), Tursdale (NZ3135) and Favordale, Darlington (NZ2816) in 2003.

## Hydrophilidae

*Enochrus melanocephalus* (Olivier)

Initially recorded in County Durham from Brinkburn Pond, Darlington (NZ2816) in 1986, this species has since been found in other sites in the county at Brasside Pond (NZ2945) in 1992, at Rainton (NZ3248), Tursdale (NZ3135) and Hylton, Sunderland (NZ3658) in 2002, at Cowpen Bewley (NZ4825) and Billingham (NZ4623) in 2003 and at Quarrington (NZ3337) in 2004. It has also been found in south Northumberland (VC 67) just north of Whitley Bay (NZ3575) in 2003 and at Small Burn (NY9480) and Ellington (NZ2793) in 2004, the latter the most northerly British record.

*Laccobius sinuatus* Motschulsky

Eyre *et al.* (1985) reported this species from Stargate (NZ1663, VC 66) in 1981 and there were further records in County Durham from New Herrington (NZ3353) in 1991 and Chilton Moor (NZ3248) in 2000. Recent recording has generated more records in this county from Wingate (NZ4037) and Black Hurworth (NZ4134) in 2002 and North Gare (NZ5327), Murton (NZ4046) and Tursdale (NZ3135) in 2003. It was also found at Wallsend (NZ3169) and Cambois (NZ3083), both in south Northumberland (VC 67), in 2002 but the most northerly British records are from a mosaic of ponds next to Druridge Bay (NZ2698/2798/2796/2796) in June and July 2002.

## DISCUSSION

There is an obvious trend of aquatic invertebrate species spreading northwards in Britain. The recording of mainly southern British water beetle species in north-east England, such as *Hydroglyphus geminus* (F.) in the mid-19th century and *Dytiscus dimidiatus* Bergstraesser in 1969 (Eyre & Foster, 1984), indicates that there have been previous range expansions and contractions. However, the recent distribution changes across a range of aquatic invertebrate species groups, and with some species recorded from a considerable number of new sites, appear to show a stronger trend than those observed previously.

All the species with expanding ranges had similar habitats, except perhaps for the brackish water snail *A. grayana* and bug *S. stagnalis*. The other species were all recorded from relatively open, permanent ponds with vegetated edges and open

water. There were differences in the extent and coverage of vegetation in the pond edges but the edges tended to be relatively open with considerable bare substratum. Another common factor was that a number of the sites were relatively new and the product of land reclamation or construction for leisure activity. There appears to have been a change away from the pattern of lowland freshwater habitat removal with the provision of these new water bodies, at least in north-east England. The ponds at Tursdale are small square fishing ponds, those at Big Waters and Silksworth the product of deep mine reclamation and those next to Druridge Bay an exercise in wetland habitat construction following opencast coal extraction. As Merritt *et al.* (1996) pointed out, the reclamation of mining sites has produced new ponds and lakes and therefore new aquatic invertebrate habitats.

Houghton *et al.* (1996) predicted increasing British temperatures and there has been much recent work on invertebrate species distribution change relative to British temperatures, especially on butterflies (e.g. Hill *et al.*, 2002). Other work based on the data in national recording schemes has concentrated on the potential effects of temperature rise on distribution change, with, for instance, work with dragonfly and hoverfly species (Eversham & Cooper, 1998; Morris & Ball, 2005). There are considerable problems in using phytophagous invertebrate species as monitors of environmental change because of restricted habitat availability, as Hill *et al.* (2002) pointed out for butterflies. It is possible that predator and scavenging species such as water beetles and dragonflies will be more suitable for assessing environmental change, given sufficient water bodies. The recording of so many aquatic species with expanding northern ranges is in line with observations on other invertebrate groups. The relatively comprehensive coverage of Britain by such recording schemes as those for dragonflies and water beetles, and the ease of sampling and generation of distribution data, mean that observed changes in aquatic invertebrate species distribution patterns are likely to reflect ongoing environmental change.

#### ACKNOWLEDGEMENT

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## SHORT COMMUNICATION

**A contribution to the distribution of *Zicrona caerulea* (L.) (Hemiptera: Pentatomidae) in Scotland.** – The small bright blue plant-bug, *Zicrona caerulea* (L.) is unlikely to be overlooked – or is it? Its distribution seems to be poorly documented. In spite of Southwood and Leston (1956, *Land and Water Bugs of the British Isles*) giving the distribution of *Z. caerulea* as “most areas of Britain”, and both Bedwell (*Entomologist's Monthly Magazine* 81 (1945), 253–273) and Masee (*ibid.* 91 (1955), 7–27) recording the species from “Scotland”, we can find only a single Scottish locality recorded in the literature *viz.* I. Patterson reported larvae on bramble near Ayton (VC81, Berwickshire), 14.viii.1961 (see McNeill, *History of the Berwickshire Naturalists' Club* 36 (2) (1963[1964]), 175–183). In spite of this the National Museums of Scotland's collections contain a number of specimens from Scottish localities, namely:

- VC73 Gatehouse of Fleet, vi.1946 (D. E. McK. Kevan coll.)  
 VC82 Garvald, 2.vii.1951 (A. Clarke coll.)  
 VC83 Edinburgh, pre-1858 (R. K. Greville coll.)  
 VC85 Kinross, 12.viii.1940 (D. E. McK. Kevan coll.)  
 VC89 Kirkmichael, 16.viii.1937 (R. W. Brown coll.)  
 VC90 Tarfside, 13.vi.1958 (T. Huxley coll.)  
 VC96 Newtonmore, vi.1903 (J. E. Black coll.)

To these can be added further records by the authors, namely:

- VC79 Williamshope, 29.v.1994 (K.P.B.)  
 VC86 Dunmore Moss, 3 & 4.viii.1982 (R.M.L.)  
 VC89 Lower slopes of Beinn a'Ghlo, 29.vi.1986 (R.M.L.)

The species is thus widely distributed throughout the southern half of Scotland but is always very local. – K. P. BLAND, National Museums of Scotland, Edinburgh EH1 1JF and R. M. LYSZKOWSKI, “Glenwood”, 57 Henderson Street, Bridge of Allan, Stirling FK9 4HG